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ENSO-Related interannual variability of temperature and salinity in the upper tropical Pacific Ocean during 2005-2006

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On the basis of the latest Argo data archive (ftp://ftp.ifremer.fr/ifremer/argo/geo/pacific_ocean), the ENSO-related interannual variability of the temperature and salinity in the upper tropical Pacific Ocean was investigated. Associated with the 2005-2006 ENSO cycle, the major variation of temperature was trapped in the sharp thermocline. During El Niño, the greatest subsurface warming occurred along the equatorial central and eastern Pacific Ocean, and the greatest subsurface cooling was found along both the major thermocline ridge at about 5°N-15°N and the secondary thermocline ridge on the equatorial Pacific western boundary. The asymmetric distribution of the thermocline ridge about the equator played a major role in that of the subsurface cooling about the equator. Along the thermocline ridge, the subsurface cold water was nearest to the sea surface due to the greatest shoaling of the thermocline, which acted together with the greatest sharpening of the thermocline to make the subsurface ocean respond substantially to the atmospheric forcing. Therefore, according to the subsurface ocean memory mechanisms, the thermocline ridges at about 5°N-15°N and on the equatorial Pacific western boundary might be the crucial region for ENSO phase transition. The major variation of salinity was confined in the surface isothermal layer. During El Niño, along the ITCZ, including the eastern edge of the western Pacific warm pool, the strong freshening was found there due to severe rainfall. However, the greatly increased sea surface salinity was found on the southern flank of the high-salinity North Pacific Tropical Water (NPTW) due to the combination of the southward movement of the NPTW and the increased dryness, and also in the southeastern part of the SPCZ partly due to the increased dryness. The variation of subsurface salinity was also trapped in the thermocline and was synchronized with the major variation of subsurface temperature due to upwelling/downwelling. It was worth noting that the greatest decreased salinity and temperature was trapped in the thermocline on the equatorial Pacific western boundary, indicating that there existed a strong upwelling, maybe the strongest upwelling in the tropical Pacific Ocean. In conclusion, the major thermocline ridge at 5°N-15°N and the secondary thermocline ridge on the equatorial Pacific western boundary might be the crucial region for ENSO phase transition. Worthwhile noting, on the equatorial Pacific western boundary, there might exist the strongest upwelling in the tropical Pacific Ocean, which might be a deciding factor in ENSO phase transition. The future works will be focused on checking if the major and secondary thermocline ridges are crucial region for ENSO prediction. KEYWORDS: ENSO, interannual variability, temperature, salinity, thermocline Acknowledgments. This work was supported by "Interannual variability of the western Pacific subtropical high's introseasonal oscillation during boreal summer and its effects on the Mei-Yu heavy rainfall" through Grants 40605019 and by "Modification of physical schemes of a middle complex tropical ocean model" through Grants 40575034, both funded by the National Natural Science foundation of China.